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WOODLANDS IN THE FARM PLAN



FARMERS'
BULLETIN
NO. 1940

U. S. DEPARTMENT OF AGRICULTURE

THE WAR HAS brought new demands for farm products, and farmers are doing their part to supply not only the grain, fiber, and fat, but also the products of their woodlands needed to win the war. Farmers want to do all this without wrecking good land because, obviously, we must retain our productive farm land for use after this war is over.

This bulletin is for farmers interested in developing a good woods and an income therefrom or in saving, through management, the woodlands they now have. Briefly, it attempts to marshal the facts and assist any interested farmer in deciding what to do with his woods. Once he has decided that he wants to grow and harvest wood as a farm crop, he will need help in the details of practices. Selecting trees and products in reference to the best markets, as well as with regard to the growing stock to be left, are points on which farmers are not usually well informed. Forestry bulletins are available that tell how to put various forestry measures into effect. The Soil Conservation Service can give some field assistance, and the county agent or the State agricultural college will put farmers in touch with other agencies that may assist.

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WOODLANDS IN THE FARM PLAN

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THE WOODLAND IS A PART OF THE FARM

HERE ARE A FEW favored spots in our country that include only land so productive and of such gentle slope that all of it can be used for cultivated fields, pastures, and meadows. On a majority of the farms of the United States, however, a woods area will be found. On the treeless plains, farmers go to great expense and trouble to plant, grow, and care for, on the best plowlands, woods that were not there when the land was homesteaded. In other localities, where most of the farm land was originally covered by woods, farmers have been busy for generations clearing land for tilled crops and pastures. Over half of the 6 million farms in the United States have woodlands. The proportion of the total farm acreage in woods for the United States as a whole is about 17 percent; in the Northeast and in the South this percentage over wide areas is between 40 and 60.

Fortunately, because of the character of the land, several generations of farmers in these areas have failed to get rid of the woods; so now the question is, shall we be satisfied with a woods yielding a little forage and the fuel and fence posts that are needed on the farm, or shall we take hold of this woodland field and develop it so that it will contribute to the support of the farm? If the question of yields concerned a poorly developed pasture, meadow, or grainfield, there would be no doubt about the answer because farmers take pride in getting high yields. They know that success in farming depends on making all of these fields produce to their maximum capacity; nor is there reason to hesitate when it comes to the woodland areas.

The nature of tree growth, and, therefore, the character of the woods crop, is different from that of a grain or a livestock crop. Nature stores up the wood growth from year to year so that it is possible for the farmer so to arrange the harvesting of the woods crop that it will

¹ Illustrations by Katharine R. Johnson.

not conflict with other farm operations. The wood can be harvested after the wheat is cut, after the hay is in the barn, and after the cotton is picked or the corn shocked. Work in the woods can be carried on when there is snow over other fields and when the cold is bitter, making it difficult to work anywhere else. From the earliest days, men have recognized the woods as a good place to work in the winter. If there is any idle time on the farm, there should be an opportunity to make use of it in the farm woods.

The ability of the woods to store its harvest from year to year must be recognized in its management. The flexibility of harvesttime provides an opportunity to fit it into the seasonal farm-labor calendar and also carries with it an obligation not to cut too deeply into the stored wood growth at any one time. Otherwise, nature's gift of an ever-normal living wood storage, to be used like money in the bank, soon will disappear. Used as principal from which to draw interest currently and, infrequently, to dip into to tide over emergencies, it becomes an excellent stabilizer of farm income. A wood harvest that is to be a regular part of farm business is based on two elements—the soil and the growing stock of living trees. Both must be maintained to obtain a wood crop, and both must be managed to get maximum yields.

Taxes on farm lands in the United States, according to the Bureau of Agricultural Economics, average about 39 cents per acre. In the South in 1940 they ranged from 14 cents in Georgia to 51 cents in Florida. In the Northern and Western States the averages run to 75 cents and higher. Everybody should pay his share and every acre of land should bear its share of the properly apportioned taxes. Let us take, for example, a 100-acre farm where 35 acres are in woods that are producing practically nothing. At the rate of 40 cents per acre, the taxes on this farm are \$40, but if only 65 acres are productive, these taxes must be paid by 65 acres instead of 100, which amounts to over 61 cents per acre.

There are other things like interest on the mortgage, interest on money invested in buildings, the cost of roads, and the charge for overhead that are similar to taxes in their application to the land. The nonproductive acres just do not pull their load. No farmer can realize the full potential income from his farm until he puts his fields in the best possible condition to produce crops at a low cost. It is therefore only good business to manage the woodland so that it can do its part in helping the farmer make a living.

How important is the productive capacity of the farm acres that are commonly known as the woods? How important is it to develop the capacity of those acres to produce a maximum quantity of wood products? It naturally depends upon the farm. If we are talking about a 400-acre farm with 10 acres of woods, then from one standpoint it is not very important, because no matter how efficient that 10 acres of woods becomes in producing high-valued wood crops, they would still be relatively insignificant in the whole business of that farm. The farmer could, doubtless, survive neglect of his 10-acre woods or of a 10-acre pasture, but, nevertheless, that 400-acre tract would be a better farm and would produce a larger income if the productive power of every acre were put to use. If we consider a farm of 100 acres that has 40 acres of woodland, then the productive ability of that 40 acres be-

comes exceedingly important. Forty acres out of 100 represents the situation on about one-third of the farms in the United States. The income from such farms can be more satisfactory if the woodland is allowed, or rather trained, to do its part. It is the idle land on a farm which is often the key to a more prosperous living. If this idle land can be turned into productive woodland, it can add much to the income from the farm.

LANDS SUITABLE FOR WOODS

We know that all land is not suited to and cannot be used profitably or permanently as cultivated fields, pastures, or meadows. Millions of acres of eroded slopes and abandoned fields on farms testify to this truth. Much land unsafe for cultivation can be profitably managed as woodland (fig. 1). Some of this land has to be reforested to get it back into production. Reforestation is expensive, and often it will be a long time before the results begin to show in farm income.



FIGURE 1.—Land breaks down under cropping beyond its safe limit.

The effect will be felt much sooner in the increased capital value of the farm. Nevertheless, it is necessary to protect and heal such land that has been ruined by misuse, or overuse, with a cover that will restore it to productivity. Some land, on slopes with erodible soil, cannot be safely or permanently used for other than woodland or wildlife crops. If such areas are managed so that they produce a satisfactory income from the forest, there will be no temptation to destroy the cover.

Other sandy, relatively sterile lands are known to be most useful and profitable if devoted to and managed for the production of forest crops. If not now in forest, their reforestation is indicated. As previously mentioned, farmers in the Great Plains often plant trees on lands of high capability because of their recognized protective value in addition to their usefulness in producing posts and fuel needed on the farm.

To make a profit from woodland the farmer must be willing to train it to produce systematically. He must make up his mind that

it is feasible to have a woods that will bring in some income instead of having a brush patch good only for rabbits or as third-class forage for the cows. Every important structure—like a bridge or a public building, or a monument in a park—that has permanent usefulness or beauty is dedicated; so, figuratively speaking, because they are to become a permanent, useful part of the farm, certain fields can well be dedicated for permanent use as woodland. This is essential because a worth-while growing stock of trees cannot be developed in a day.

Two kinds of land may be selected for woodland: (1) Land that is clearly best adapted, by nature or by man's misuse, only for some form of woody vegetation; and (2) land that is from the standpoint of its capability suited to other uses.

Land in the first class, which may safely or economically be used only for some form of woody vegetation, may be devoted to the production of wood products, to wildlife, to recreation, or to any combination of these uses. It may sometimes be advisable to hold forested land solely for park or recreation purposes. A particular piece of brushland or even timberland may have a greater value for recreation than for anything else. Or a town may be building in the direction of the farm, and it might be wise to conserve the forest cover carefully with the view that the land may be in demand some day for building lots. Obviously what is done in managing a particular piece of woodland depends upon what the purpose is in holding it. If wood crops seem to be the best prospect, certain fields should be set aside for them. Some of such land now may be bare, such as eroded fields abandoned for cultivated crops or for pasture, and must be reforested. Most of the fields, however, so dedicated to production of wood will be lands already in a woods cover of some sort.

The second class includes land now timbered and bare land which, for special reasons, a farmer may wish to use for woodland and for which he is willing to pay the expense of planting. The big problem, however, is encountered with timbered lands. On many farms, especially on the Pacific coast, there are forested lands that may be physically suited to other uses.

The farmer will have to decide whether to clear the land of timber and put it into some cultivated crop or pasture or to leave it in woods and develop it as a woodland. A number of factors must be considered. Many mistakes have been made in the past in clearing land that looked promising for cultivation but later proved unprofitable. This much is certain: It costs a good deal to clear land of timber growth. If no values are assigned to the timber products cut from the land, it usually costs somewhere between \$50 and \$150 per acre for clearing. Then there is the cost of conversion—plowing, seeding, fertilizing—and if the conversion is to pasture, there may be failures before a good stand of grass is obtained. All of this takes capital as well as labor. If the labor is available and not otherwise readily usable, perhaps the cost of the labor is not an important factor. The income to be obtained from the land after clearing as compared with that from management of the existing forest is of first importance. The income from a well-managed woods is discussed on pages 16 to 19. The only point to be made here is that, unless the case is

clearly in favor of the conversion, it would be better to let the woods stand and assist nature in producing a worth-while timber crop on the land.

The present difficulties of our Government in obtaining timber and lumber suited to war needs demonstrate the opportunities that exist for marketing products from farm woodlands and the advantages that farmers enjoy in accessibility to markets. The United States has very considerable timber reserves in the western mountains, but this timber is expensive to get under normal conditions and it is nearly impossible to bring it out in the present emergency. Those farmers who have developed their woodlands through management and have accumulated crop trees of suitable size and quality are in a position to cut more heavily than normally to meet the war demands without seriously interrupting the flow of future annual or periodic wood harvests. Unless previous management has built up the stand, heavy cutting is likely to prove exceedingly destructive.

THE ESSENTIALS OF FARM-WOODLAND MANAGEMENT

We may well compare the methods of management of different farm crops, including the woodland crop. Cultivated annual crops like corn, wheat, and cotton involve soil management; for example, the soil must be plowed, fertilized, seeded, and cultivated. The crop is harvested by its complete separation from the soil each year. Orchard and livestock crops also require soil management; for example, the use of fertilizers and lime for orchards and pastures. Moreover, a growing stock of several age classes of cows, horses, or pigs is required for livestock crops, and different age classes of trees are needed in an orchard. Growing stock needs skillful manipulation. Trees in an orchard must be pruned and sprayed; livestock must be rotated from pasture to pasture, culls must be weeded out, the older age classes must be sold, and vigorous growing stock must be maintained at all times. All this manipulation must be done under very definite rules.

Farmers are less familiar with the rules for managing a woodland crop. This crop also involves soil management, the development of a growing stock, and the manipulation of the growing stock. All cutting operations must be conducted under rules that vary with the purpose of management.

All the rules about soil management, sowing seed, cultivating and harvesting wheat, corn, cotton, and other field crops have become familiar to farmers through practice. Orchardists and livestock growers have become familiar with the practices essential to their success. Agronomy, horticulture, and animal husbandry are not strange words to American farmers. The growing and harvesting of a woodland crop likewise requires acquaintance with good practices, and familiarity with the word "silviculture."

The methods to be used in raising a woodland crop are actually relatively simple. Though many of the techniques that foresters use in working out some of the fine points are complicated, the things that the farmer will do in the management of his woodland are not.

THE WOODLAND GROWING STOCK

After the farmer has selected the fields that are to be used as woodland, his next step in farm-woodland management is to decide what kind of growing stock to develop. This means not only the kinds of trees and the relative proportions of each in the mixtures but the sizes most likely to produce products of maximum value when harvested. The trees selected must be those adapted to the soil and the climate, that is, the best trees of the kinds desired that are found growing in the woods at the beginning of management. In the North the growing stock is likely to include such trees as white oak, red oak, maple, beech, birch, ash, and perhaps white pine, spruce, or hemlock. Farther south, southern pines would be prominent, also such hardwoods as oak, ash, gum, poplar, black walnut, and black locust. In the West the growing stock would include pine, Douglas-fir, hemlock, eucalyptus, or redwood.

The ideal stand has trees of all ages, from seedlings to mature trees, so spaced that as the big trees are harvested the next sizes move up to take their places, and the growing space is fully occupied. Actually, trees of different ages and sizes usually are pretty thoroughly mixed in the woods, but rarely in the ideal proportion.

This description of a well-developed growing stock perhaps gives a false impression that there should be no cutting until the trees, through growth, have attained proper sizes and relative proportions in the stand. That, of course, is not true, because this well-balanced growing stock is developed through cutting, and experience indicates that in most woods it takes a lot of cutting and a great many years to bring about anything like an ideal distribution of age and size classes. The woods also require protection from fire and grazing and from wind. If fires burn, or the cows eat up the young trees, the gradation in age and size classes is interrupted, and if such injuries are long continued there would naturally be an end to the forest. A close border of shrubs or young trees at the edge of the woodland will prevent the winds from blowing through and sapping moisture from the soil.

MANIPULATION OF THE GROWING STOCK

Once the growing stock is fully developed, cutting will proceed each year or, if the forest is small, perhaps every 5 years for some products. Periodically there will be removed a proportional amount of big trees suitable for making into such products as sawlogs, veneer logs, poles, piling, or specialty products like curly maple or black walnut or other hardwoods for furniture—or white oak for boats, if we are talking about the present war demand. At the same time there will be cutting for fuel, fence posts, and pulpwood, from the tops of trees harvested for other products, and at intermediate times from thinnings in stands where the trees are too thick. Thinning will serve to keep individual trees properly spaced so that the growing stock will be in the best condition to put on maximum growth. If management starts at a time when there are no big trees to cut, cutting must still proceed on the basis of thinnings or improvement cuttings from which fuel and posts, pulpwood, and possibly railroad ties and other products are obtained. There are, therefore, very few

farm woodlands where the decision to manage the woods as a crop would not involve annual or periodic cutting.

One thing is common to each step where cutting is employed. That is, every tree to be cut or to be left in the stand is carefully selected in advance of actual operations. There is a specific reason for each selection. This is the rule even where small areas are clean-cut. There is a great difference between this planned cutting and going into the woods and taking the first tree that seems to be suitable for the product wanted. The individual selection of trees is the key to good forestry practices as well as to good financial results in the management of farm woods.

The volume of timber cut annually or periodically should theoretically not exceed the growth since the preceding cutting. The important thing is not to deplete the growing stock of the largest and oldest trees too far at any one cutting. So long as the cutting is for the purpose of providing growing space for the smaller trees, no harm will come from such cutting. When trees that have reached their maturity are to be harvested, it is well, if a fairly uniform volume of cutting is desired, to have some guide or limit to the amount to be removed during any specific time interval.

A forester is trained to take samples and to calculate the growth of trees, and if a forester is available, his advice should be followed in deciding what trees to cut. If none is available, a good rule is to cut the minor products, such as pulpwood, fuel, posts, ties, on the basis of giving room to the growing stock and freeing the crowns of the trees left.

A rule of thumb for the desirable space between healthy trees left for further growth is known as $D+6$, which means that the proper spacing between any two trees expressed in feet may be found by taking their average diameter in inches at breast height and adding 6. For example, a 10- and a 16-inch tree should be spaced about 19 feet apart ($\frac{10+16}{2}+6$). A 7- and a 9-inch tree should be about 14 feet apart. If trees stand closer than this there is need for more growing space.

In addition to the volume allowed by this spacing rule, one should harvest trees of the largest sizes as follows: An average of 1 tree from each acre for each year since the last cutting. In a 40-acre woods to be cut annually, this would be a total of 40 trees; in one cut every 5 years, it would be 200 trees.²

Another rule of thumb is never to cut more than 20 percent of the volume of the growing stock in any 5-year period. For example, if the growing stock 10 inches or more in diameter amounts to 7,500 feet log scale per acre, cut not more than 1,500 feet in this period. In slow-growing stands that will be too heavy a cutting and in fast-growing timber it will be conservative. The application of this rule should include all of the material removed in the form of the major product, usually sawlogs, but not the fuel, posts, and small products removed to give the growing stock more room. If cutting is on the basis of careful selection of trees to be removed, with the purpose in

² MITCHELL, H. C. REGULATION OF FARM WOODLANDS BY RULE OF THUMB. Jour. Forestry 41: 243-248, 1943.

mind of manipulation of the growing stock so as to produce a fairly regular wood harvest as part of the farm business, experience will soon indicate safe cutting limits.

What about the cost of this planned approach to woodland management? It is of the same nature as that involved in getting a plan for a house or a barn before starting to build or in buying a pattern for a dress and pinning it to the cloth before starting to cut and sew. This planning cost is justified in worth-while undertakings.

STEPS IN DEVELOPING THE WOODLAND GROWING STOCK

IMPROVEMENT CUTTING

Cutting farm wood required for fuel, posts, and poles in such a way as to improve the growing conditions of the woods is known as



FIGURE 2.—Removal of diseased and crooked trees and of undesirable species gives the thrifty trees room to grow. The products usually are fuelwood and posts, but sometimes pulpwood and an occasional sawlog are included.

improvement cutting (fig. 2). It is often the first cutting of a hitherto-unmanaged woods in order to remove the culs and cripples and generally renovate the stand. The best trees are given sufficient space horizontally and vertically so that they get the benefit of the sunlight, the air, and the moisture from the ground, which are required for satisfactory growth. One good tree is worth many poor ones. Quality brings a high price per unit volume.

The actual operation is first to mark for cutting (with ax, paint, or some sort of bark scraper) the poorest trees, always with reference to the trees that are to be left for further growth. In other words, leave those trees of best species, form, vigor, and spacing, and mark the remainder for cutting. The trees to be cut will usually make the products that are in demand on the farm. The only extra cost involved is that for the selection and marking of the trees to be cut; that is, the planning cost of a worth-while job.

THE HARVEST CUT

The harvest cut is defined as cutting for the principal purpose of harvesting final-crop trees of any size produced in accordance with the plan of management. When individual trees or groups of trees reach the size and quality intended, they are considered mature. It is then time to investigate the market and find out what products can be cut from these trees that bring the best prices and the market specifications for such products. The harvest and improvement types of cutting are often made at the same time and it is important to keep in mind the distinctions between them because different rules apply.



FIGURE 3.—When the trees are ready and the market is right, it is time to cut the big trees into sawlogs, poles, and fuel and some trees into pulpwood. In a good woods the next cut is always in sight.

Unfortunately, the market for farm-woods products has not yet been developed to the point where you can refer to the newspaper or listen to the radio and get market quotations. The local Soil Conservation Service or Forest Service representative will have some information; so will the county agent, the extension forester, the State forester, or the State agricultural college. In any case, it will pay to investigate the market before cutting. If your harvest cut is only a small quantity, for example, of sawlogs, it may be best to haul the logs to the mill and then haul the lumber back for use on the farm or for sale to neighbors. Before cutting is started, go through the woods and carefully select and mark all the poor trees that the market will take, together with the crop trees selected for removal (fig. 3). Then cut these trees so as to do the least damage to the growing stock you are beginning to build up.

The selection of trees to come out and those to be left is not often an open choice. For example, the market may be for railroad ties, which are generally low-priced products, and consequently, it would usually pay to hold any trees that give promise of growing within a reasonable time from tie size to sawlog size. Sawlogs as a rule are worth more than ties. The usual tie-size trees are 11 to 15 inches at a point $4\frac{1}{2}$ feet from the ground. A 12-inch tree may produce two railroad ties that have an average value in the woods of 50 cents apiece, or a total of \$1 can be obtained for salable products from that tree. Assume that this tree is growing at the rate of 3 inches in 10 years, which is fairly good growth; in 20 years it will total 18

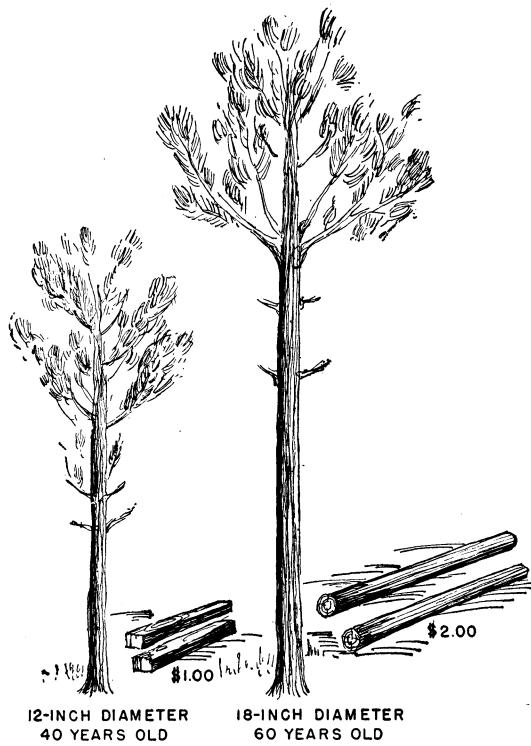


FIGURE 4.—A 12-inch tree that is allowed to grow for 20 years will double in value.

inches, and at that time it will yield 200 board feet, Doyle rule.³ At \$10 per thousand feet in the same location where railroad ties are worth 50 cents, the products from this 18-inch tree will be worth \$2. In other words, the 12-inch tree allowed to grow for 20 years will double in value. The tree has earned $3\frac{1}{2}$ percent compound interest, which is equivalent to about $5\frac{1}{2}$ percent simple interest (fig. 4). Sawlogs may be worth more than this calculated price in 20 years.

What is the cost involved in this? Again it is just the cost of spending the necessary time and thought, and thinking the thing out.

³This is the most commonly used rule for estimating the lumber than can be cut from logs. For small logs the actual lumber cut usually greatly exceeds the log-scale measure.

The time spent in investigating the market is worth while either because of the increased price obtained or because of the satisfaction in knowing that you are getting the full value. The reward is partly in the future, because this care in selection is necessary to build up the growing stock. The real profit is to come later, after those vigorous trees that were not cut reach maturity.

PRUNING

So far, we have talked about steps in developing a woods growing stock in which the products to be cut pay their own harvesting cost. There are other woods operations that speed up the work of developing a good growing stock but do not always produce any salable or immediately useful products. They are in the nature of investments for the future. Most farmers are accustomed to making some investments for the future. For example, when he clears land to make a cornfield the farmer is investing a present cost with the hope that future returns will justify it. Again, a farmer makes a present investment with the hope of future returns when he buys young livestock for feeding and for sale in a future market. And so, pruning and the other silvicultural practices that follow will stimulate the growth and improve the quality of the future timber crop, and thus insure a better future income. Silvicultural practices are the "woodland vitamins" administered to improve the health of the stands. They are the tools to use in producing the trees that make the money in the later harvest cuts.

Pruning is defined as the removal of limbs, living or dead, in order to improve the utility of the standing tree or the amount or value of products to be obtained later. Pruning is usually confined to coniferous trees; the length of the stem pruned should never exceed two-thirds of the total heights of the tree (fig. 5). From 200 to 250 trees per acre are selected from small trees, and all the lower limbs are removed. Usually the best procedure is to prune them to a height of 10 to 16 feet when the trees have reached 4 to 6 inches in diameter, and later, before they have become 8 inches in diameter, to a height of 25 to 32 feet. This does not mean pruning every tree, but only those that are of a character and are spaced so that we may hope they will grow into final-harvest trees. According to the Southern Forest Experiment Station, the pruning of crop trees in dense stands promises to increase the value of the harvest \$100 or more per acre as compared with stands which are not pruned. At present, owners of high-quality saw timber, in most cases, receive a considerable premium over "woods run" stumpage values. Since grade No. 1 logs are worth about 4 times the value of Grade No. 2 logs and from 6 to 20 times the value of rough or Grade No. 3 logs this practice of paying a premium for high-quality material is quite certain to become firmly established in the future. It will therefore pay the timberland owner always to attempt to grow clean, high-quality material rather than just so much volume.⁴

Where labor is especially hired for pruning trees, the cost runs from 1 to 4 cents per tree. For 200 trees per acre it would be \$2 to

⁴ Reynolds, R. R. SOME PRINCIPLES OF FARM WOODLAND MANAGEMENT. Southern Forest Expt. Sta. 1941. [Processed.]

\$8 per acre.⁵ If it is done at a time when the labor is not in demand for other farm work, it will prove a very good investment.

THINNING

Thinning of dense young stands is a matter of selecting the crop trees and giving them room to grow (fig. 6). The rule of thumb for spacing previously explained, $D+6$, is applicable here. For example, 6-inch trees should be spaced about 12 feet apart. The Southern Forest Experiment Station has found that thinning in dense stands results in subsequent growth often many times that of the stands left unthinned. The experiment station advises that



FIGURE 5.—Selected crop trees are pruned of lower limbs for one or two-log length. Pruning pays good dividends in improved quality of the product.

farmers plan to start thinning in dense stands at least as soon as the trees become usable for any purpose and then make repeated light thinnings every few years in order to prevent slowing up of the growth rate. The cost of thinning is largely labor. Where the trees removed can be worked into products usable or salable no question of desirability of the operation arises. If the trees cut cannot be used, then probably the thinning is justified only on the basis of readily available labor; that is, if there is no more urgent work to do on the farm.

INTERPLANTING

Interplanting (fig. 7) is needed under conditions just the opposite of those found in dense stands, namely, where the growing stock is

⁵ On the Pacific coast experts advocate pruning Douglas-fir to a height of 35 feet and claim that it can be done for 10 cents per tree. Special climbers have been developed, and often a club can be used instead of an ax or saw.

not complete, the stand is not fully stocked, or the ground is occupied by poor species. It may be needed if natural reproduction is too slow in getting started or if seed trees are lacking. The farmer may desire to establish an entirely different species, for example, pine in a mixture with hardwoods. It may be that the large pines were cut last winter and there is no sign of young pine trees; instead, hardwood seedlings and brush are getting a start in the openings. Then it may be wise to get the pine trees established without further delay, in which case it will be necessary to interplant. Usually, suitable seedlings can be purchased from the State nursery or from commercial nurseries and the trees planted in the open spaces where light reaches the ground. Where planting is done in the open, the spacing is usually 6 feet by 6 feet, which requires about 1,200 trees per acre, but in interplanting where advantage is taken of open spaces it is seldom possible to find places for more than 200 or 300 per acre.



FIGURE 6.—Having too many trees in a forest results in stagnation of growth. Taking out part of the trees speeds up the growth of those remaining.

Usually trees cost between \$1.50 and \$5 per thousand, and they can be put into the ground at the rate of about 500 per man-day.

RELEASE CUTTING

The planted seedlings or sometimes those established by natural reproduction may require release cutting—the removal of overhead shade caused by brush or other advance growth. This is not a very difficult or time-consuming operation; it can be done quickly with a hand ax or machete, often with one stroke for each stem to be removed. Systematically going back and forth over the woodland, cutting back the undesirable growth and giving the desirable species and young trees of good form a chance to grow, has a remarkable effect on the growing stock. It will eventually be reflected in the quality of the woodland products. The cost of release cutting is not very great so far as the actual labor is concerned, but such cutting has to be planned by some-

body who has a picture in mind of what the woodland should eventually look like. The farmer cannot very well delegate this to a hired hand unless he has trained him to do this specialized work. It might be turned over to his son, however, if he is interested.

REMOVAL OF WOLF TREES

Wolf trees are those big spreading trees, often beech, gums, or scrub pines, that must be removed in order to make room for better, younger trees. Removing them is really a part of an improvement cutting and might be so classed. Wolf trees can be cut and worked into some useful product, such as fuel wood or pulpwood, or if this is not practical, sometimes they may be killed by girdling. It is, of course, possible to poison trees, but it is doubtful if poisoning would be any cheaper than girdling. Killing trees and allowing them to stand has one serious objection—fire risk is increased. In localities of high fire hazard there is no desirable alternative to felling such trees.



FIGURE 7.—A complete cover is as necessary in growing wood crops as it is for cotton or corn. Interplanting thickens the stand and introduces "new blood" into the growing stock.

PROTECTION FROM GRAZING

Protection from grazing damage must be assured before woodland management is undertaken. Usually this requires complete exclusion of such domestic animals as sheep, goats, horses, and cattle, but it may mean only regulation of grazing so as to hold the damage to a reasonable minimum. This is a farm problem that must be solved for each farm in consideration of the type of forest, kind of domestic animals, and the intensity and season of grazing. To help the farmer make a decision, some general statements drawn from past experience are given.

Experiments show that the cows get little nourishment out of what they find to eat in hardwood forests, and as a rule they do great damage by browsing and trampling. Unfortunately seedlings of the better species seem to be most palatable to livestock; hence building up the growing stock by encouraging reproduction of the best trees, as well as

maintaining growth by keeping the soil loose and porous and protected from desiccating winds, becomes very difficult if grazing is not eliminated.

In the ponderosa pine forests of the West, grazing cattle, horses, and sheep is consistent with timber growing if the number of animals is adjusted to the available forage. This type of forest provides palatable grasses; the young pine trees are not palatable to livestock and are seldom eaten as long as the grasses are available.

In the pine forests of the South the grasses are low in palatability, but considerable stock is grazed. Cattle range through the woods with little regard to ownership lines and with moderate regulation, danger of serious damage to reproduction is slight. Where woodland pastures are fenced, damage to pine seedlings can be serious if too many head of cattle are grazed. Once the young growth becomes well established, however, the forage is so depleted by shade as almost to exclude use for grazing. Sheep and goats will eat buds and new growth on pine seedlings and should be fenced out of pine plantations and stands having seedling reproduction. Longleaf pine forests should be protected from hogs, sheep, and goats at times when regeneration of the forest is taking place. Grazing in southern pine forests on the basis of native grasses is generally uneconomical. The real solution to the grazing problem is to use improved pastures and grow hay crops.

Does a policy of protection require a fence to keep the cows out of the woods? These fences cost something; so do fences around pastures to keep the cows in. Does the cost of building a fence to keep the cows out of the woods represent the cost of timber growing, or the cost of cattle raising? This is a question of how the cost is figured and who figures it. The operation of a farm requires a number of miles or rods of fence. It also requires buildings and roads. These things are a part of the farm plant. There may be a small corner or a narrow fringe of woods where it surely would not be worth while to build a fence. In such cases the fields may be too small for use for woodlands.

PROTECTION FROM FIRE

Fortunately, on the great majority of farm woodlands protection from fire is not difficult. This is true of the smaller woodlands that are separated or surrounded by cultivated fields or pastures. Ordinarily, fire-prevention measures on the farm and quick action to stop fires that may start are the only steps required. In some regions, however, forest fires are a community problem, either because the general sentiment favors annual burning of the woods or because no organized effort has been made to get at and eliminate the causes of fires or to maintain an organization for the detection and prevention of fires. Where farm woodlands are parts of large wooded areas, such as the continuous coniferous forests in the West and the South, individual farmers often are powerless to prevent fires from destroying their wood crops. Community action is therefore required, and in most States the State forester, with the assistance of Federal funds, has the authority and the means of maintaining a fire protective system. In some States fire districts are organized in which private owners pay part of the cost of protection. There are few

localities in the United States where the fire problem cannot be solved by community action if the farmers and other timber owners want the fires stopped. Often farmers must take the initiative in organizing some sort of a protective association, but both State and Federal organizations are anxious to help, and local people can obtain this help by soliciting it, especially where they are willing to assume part of the cost of protection.

In many farm woodlands protection is facilitated by the proper location of fire lanes and roads. Fire lanes are of various types and range in width from 2 to 20 or more feet. Along some of these strips removing the brush and young trees and raking the leaves each year is all that is needed. Where the fire danger is greater, these fire lanes may be made into plowed strips that are disked sufficiently to keep down vegetation. In some places such strips are seeded to grass and mowed periodically. In others the fire lanes are made into roads so as to serve a dual purpose.

Proper disposal of the brush and other refuse in connection with logging operations may be an important fire-prevention measure. The manner in which brush is disposed of depends on the fire risk in the locality. Where the risk is high, piling the brush and burning it during safe periods is usually advocated. This is true in most of the western coniferous forests. If the fire risk permits, it is far better from the standpoint of good silviculture to lop and scatter the brush. The recommendation of the State forester for any particular locality is the best guide to brush disposal.

CONTROL OF EROSION IN THE WOODLAND

A well-stocked woodland protected from fire and grazing offers no erosion hazard. The problem of soil erosion on the farm is largely one of open fields. In a forest, the overhead tree canopy and the forest floor, protected by the leaf litter and kept porous and granular by the roots and the living organisms in the soil, act as effective barriers to erosion. The cutting of the forest, especially where silvicultural requirements may demand some small areas of clear cutting, may cause some temporary soil erosion, but this erosion will be very temporary if good silvicultural practices are followed. In fact, the initial stage of erosion in the form of soil movement in the forest is often one of the indications of too heavy cutting. Another indication of the same thing, which may later result in soil erosion, is the drying out of the topsoil and the absence of leaf litter, obviously caused by too much exposure to sun and wind. All of these indications will be watched for by the good forest manager. Precautions to be taken in connection with logging operations are the location of the skid trails and roads as nearly on the contour as possible, throwing brush and limbs on any spots where the soil has been exposed in logging operations, and cutting lightly on steep slopes and on any slopes where the soil seems to be unstable.

MANAGED FARM WOODS PRODUCE SATISFACTORY INCOMES

Foresters repeatedly have said that present neglect in management of farm woodlands means that woodlands are actually producing only from one-third to one-half of what they are capable of producing.

This means that about 500 million dollars in potential income from farm woodlands has never been realized by farmers in the United States simply because they have failed to develop and manage a growing stock in the woods that would make possible the realization of this income. To neglect the woodland is to neglect a considerable part of most farms, and unquestionably the public as well as the farmer's interest demands the development of such areas. Only in such national emergencies as that created by World War II do we fully realize the public concern in how the individual handles a natural resource such as timber. Patriotism, self-interest, and the public welfare all point in the same direction.

It is not difficult to find examples of satisfactory incomes from farm woodlands which have been managed for a considerable time and where cutting is reported to leave an adequate growing stock. It is difficult, however, to get all the facts about costs, soil conditions, volume of timber cut and left, and the gradual improvement of the growing stock through management. Farm-forestry demonstration projects were started a few years ago in the majority of States; in those states cooperating farmers are keeping accurate records of these essential facts. It will be another 10 or 20 years before these records can be offered as proof of the financial advantages of management. In the meantime we shall have to be satisfied with records of income which are convincing if not always airtight proof of the results of good management.

There is, of course, a wide variation in the productiveness of farm woods, and, therefore, in the possible income. Some farm woodlands are on good bottom land. They obviously can produce a better income than those located on rough, barren, thin soil. Nearness to markets is a favorable factor. Numerous studies of woodlands, conducted by the forest experiment stations and by the Soil Conservation Service, show that, once a good growing stock is established, the average farm woodlands will produce annually from 200 to 500 board feet in lumber per acre. This is in addition to not less than a half cord of wood in the form of fuel and posts obtained from the tops of sawlog trees and from thinnings. European experience indicates that the yield in final-crop trees of a well-managed forest represents only from 40 to 60 percent of the total volume of wood that can be obtained if all of the wood produced is utilized. If we assume \$10 per thousand board feet as the value of the logs and \$3 per cord as the value of the fuel wood cut and piled in the woods, 40 acres of timberland yielding at the above rates would produce annually \$140 to \$260 in revenue, or \$3.50 to \$6.50 per acre. If an income from maple syrup, for example, is added, or if the farm is located in the South and yields naval stores, or in the Pacific Northwest and produces cascara, these amounts can be exceeded.

Recently in Indiana a farmer who was given assistance by the Soil Conservation Service obtained the following prices for some timber as it stood in the forest, or "on the stump": \$100 per thousand feet for butt logs, \$70 for upper logs of black walnut, \$40 for hard maple logs. Such prices have been stimulated by the increased demand brought on by the war. This farmer had the foresight to let his best trees grow until size and clear length permitted cutting high-grade products. Quality timber is always in demand.

A farmer in New York State had 28 acres in hardwoods on a 164-acre farm. His records show that in 20 years he obtained \$5,000 from his woods, or about \$9 per acre per year. The management plan made for his woods in connection with a farm conservation plan indicates that by making use of the returns from sugarbush, this income can be increased to almost \$12 per acre per year. These figures include the labor of producing the sirup and of cutting the logs.

Maple sugar or sirup production is a good example of woods undertaking which, as a part of the farm business, can show a profit. Maple sirup rarely sells for enough to show a satisfactory profit as a single commercial undertaking. As a farm enterprise, however, it has proved very satisfactory, partly because the work comes at the time of the year between winter and spring when farm labor can be used without interfering with other farm activities and because farmers who produce maple sirup have learned how to sell it. Many other wood products show a larger margin of profit and less exactness as to time of harvest but require more complicated arrangements for satisfactory marketing. Large quantitites of low-grade wood are used for fuel in boiling the sap, which means a home market for products obtained from various silvicultural operations. This is a big advantage in the development and management of a farm woodland.

In Louisiana a farmer with an 80-acre farm has 28 acres of woods on only 11 of which is there any merchantable timber. A wood buyer offered this farmer \$7 per acre for the 11 acres on a clear-cut basis. The farmer, however, decided, upon the advice of a forester, to sell only on an individual-tree basis. He cut and sold the logs himself and found that after expenses had been paid he had netted \$10 per acre for the selected timber that was sold. Moreover, he had made an improvement cutting, which is the first step toward developing his growing stock.

One farmer in Alabama has been getting an annual return of \$4.65 per acre from his woods and has every prospect of increasing this income to \$6.50 per acre, through management, within a few years.

In California, along the foothills of the Sierras, amidst the early gold diggings, the Soil Conservation Service found farmers who had considerable acreages of ponderosa pine woodlands from which very little income was being received. Although a great many farmers had about half of their farms in second-growth ponderosa pine, sugar pine, Douglas-fir, cedar, and oak, the farm economy was based largely on orchards and livestock. The farm conservation program provided for crop rotations, cover crops in orchards, improved methods of handling irrigation water, seeding and fertilizing pastures, and farm woodland management. But to these Sierra farmers this idea of using the farm woodland as a source of farm income and developing it so that it would be permanently productive was entirely new. One farmer in this area was running a 320-acre livestock farm, and 75 percent of his land was in woods. Earning a living on the remaining acres was a difficult undertaking. This farmer, with the assistance of the farm conservation plan and the Soil Conservation Service foresters, found a market for his timber and began to cut with the idea of getting an income and developing a good growing stock. At last reports, he was getting a very satisfactory return from his woods, amounting to several hundred dollars yearly, using his own truck and

labor and the labor of his boys. He figured his labor at 80 cents an hour.

Under some conditions farmers can perhaps afford to sell standing timber on the basis of selected and marked trees at a rate based on measurement of the product into which the trees are to be cut. They are never justified in selling for a lump sum. Under most conditions, however, farm timber should be sold as are other farm crops, in the form of processed products, in which case the farmer sells his labor and the use of his horses, tractor, or truck, along with the logs, poles, posts, and lumber. A recent study in Louisiana showed that from 65 to 95 percent of the price of such forest products as logs, poles, piling, railroad ties, and fuel was represented by the cost of cutting, skidding, and hauling, plus a margin for profit. All or most of this might better be put in the farmer's pocket instead of in that of a transient logger.

Examples of returns under normal conditions have been selected, but other more striking examples could be given of exceptional returns because of special markets or unusual products. The experience of those farmers who have undertaken to grow wood as a farm crop proves that it is a satisfactory part of the farm business. It fits in well with the seasonal labor chart. The returns are in keeping with the productiveness of the soil and the skill in management and marketing. For most farmers, in the East or in the West, there is more gold to be found through woods management than through placer mining.

OTHER BENEFITS FROM WOODLAND MANAGEMENT

Everybody recognizes the damage done by floods, but perhaps few farmers realize that the management of their farms has an influence on floods.

Surveys indicate that not less than 200 million gullies have been formed in the United States since its agricultural occupation. Each of these has its individual watershed; and in most instances, the gradient of each little watershed has been increased by the steep banks of the gullies and the deep sheet washing that so frequently takes place near them. The number of artificial gutters between crop rows that run down slope instead of across slopes on the contour reaches into the hundreds of millions. Drainage ditches and highways, paved streets and gutters, cattle trails and fire scars, all hasten rainfall to the nearest drainage. Thus man-made and man-induced changes in the surface of the land contribute to the hurrying of runoff into streams, to overload them and to accentuate the flood hazard.⁶

A farm conservation plan that provides for woodland management in addition to stopping erosion on fields and pastures contributes the most to flood control. One farm woodland has little effect on the whole flood-control problem, but a little patch of woods here, a larger one on another farm, those on parts of thousands and thousands of farms, together make up the astounding total of 185 million acres of farm woodland—almost a third of the entire forest area of the United States. Farm woodlands are located within the more densely populated regions, where conservation of soil and moisture and the control of floods have immediate as well as far-reaching influence on the physical, economic, and social structure of our country. In the

⁶ BENNETT, H. H. SOIL CONSERVATION. 993 pp., illus. New York and London. 1939. (See p. 604).

New England States the farm woods total about one-half of the agricultural lands. The States within the drainage basin of the Ohio, though most highly organized for intensive agricultural-crop production, have almost one-sixth of the farm area in woods. Nearly one-fifth of Oregon farms is woodland. In South Carolina, Georgia, Florida, Alabama, and Mississippi, over two-fifths of the farm land is woods.

The ways in which properly managed woods affect runoff are well recognized. The tree canopy and the litter on the forest floor are among the means by which woods affect the absorption and infiltration of water. Management of the farm woodland as a part of the whole job of conservation farming will not only add to farm income and make the farm a better place to live, but it will also make a substantial contribution to the solution of our flood-control problem. The farm woodland, if allowed to do so, will join other well-managed fields on the farm in helping to hold back destructive floodwaters.

There are many different kinds of farms and farmers in the United States. There is the type of farm which is purely a business proposition, the owner of which lives in town and operates his lands through hired help or tenants. Such a farm owner is concerned chiefly with the purely business aspects—the inputs and outputs on the farm ledger. From the standpoint of public welfare, as well as his own, he has an interest in everything concerning a good woods and the development of a good growing stock, but he is badly handicapped because he is in competition in his forestry undertakings with commercial forest properties, and he has none of the advantages that accrue to a farmer who lives on the land. However, he may enjoy these advantages by sharing his stewardship of the land and his opportunity with his tenant.

There are some farmers who live on the land and make a business of farming but, for one reason or another, make life all work and no play—no hunting, no fishing, no swimming, no knowledge of or acquaintance with the birds or the beasts, and little or no social life. There is every reason why such a farmer should develop his woods because, normally, if he does, his farm will earn more money. He should manage it with the object of producing the maximum revenue.

There is yet another appeal of a good woods that is, in many instances, stronger than the commercial or business aspect. To most people who live on the land, farming, in addition to being a business, is also a way of life—by which is meant that the human satisfactions of living are largely obtained from contact with the land. The town resident's way of life often is almost wholly outside of his business. On the contrary, the farmer and his family are not dependent for most of their life satisfactions on outside attractions, because these are found on the farm and in its environs. The farmer also has his radio and social life, some trips to town, and sometimes a vacation, but he gets his chief satisfaction from the things that he does and the things he has on the farm.

A woods is a good thing to have just to look at and enjoy, and it is a good place to work. It offers the nearest thing we have to primeval conditions. It completes the picture of a good farm—a well-developed productive farm which gives those human satisfactions which we call a way of life to the man or woman who enjoys the country.

THE FARM WOODLANDS AND THE WAR

The war has greatly increased the demand for all farm products. Especially is this true of wood products, some of which in the past have not always been in brisk demand. American farmers are buckling down to the job of supplying what is needed in foods, fats, and fiber. They are doing a job comparable to that being done by the manufacturing industries in the production of guns, munitions, and war machinery.

Farmers have not only the duty of furnishing what products they can spare from their farm woodlands to meet war needs, but they have also an opportunity such as they have not had for many years to put their woodlands in productive condition by selling products not previously in demand and by taking the necessary steps to give the thrifty, immature timber a chance to develop. During these times of



FIGURE 8.—This growing stock is composed of trees of all sizes, yet there is plenty of growing space. The woods has been under management for many years. Good soil, good growing stock, and good management are the "three-horse team" that makes a farm woods profitable.

stress, farmers are under special obligation to produce what they can, without wrecking the soil. Crop production can be greatly expanded without causing serious soil loss through erosion. On the other hand, great harm can be done if farmers fail to operate in accordance with conservation principles.

Though this war may be a long one, it will come to an end, and the life of the Nation will go on and on. Hence the permanent productivity of the soil is a matter of national concern. We know that land breaks down from continuous production of row crops, or, to use an engineering expression, from use beyond its safe load limit. Land in well-managed forests, however, is not only continuously protected but is also continuously enriched. Both for the individual farmer and for the Nation as a whole, such land becomes an asset of incalculable value that may prove an anchor to windward in times of national or personal need. We shall always have woods on most farms, but we

shall not have good woods either from the standpoint of income or from that of more satisfactory living unless we actually undertake to mold them as we want them to be (fig. 8).

SOME FARM-FORESTRY PUBLICATIONS

Single copies of not more than 10 of the publications listed below may be obtained free, but additional copies can be purchased at the prices shown. The items starred (*) are available only by purchase.

Send remittances by check or money order to the Superintendent of Documents, United States Government Printing Office, Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS

Farmers' Bulletins

- 744 F. The Preservative Treatment of Farm Timbers. Price 5 cents.
- 1117 F. Forestry and the Farm Income. Price 5 cents.
- 1123 F. Growing and Planting Hardwood Seedlings on the Farm. Price 5 cents.
- 1177 F. Care and Improvement of the Farm Woods. Price 10 cents.
- 1210 F. Measuring and Marketing Farm Timber. Price 10 cents.
- 1366 F. Production of Maple Sirup and Sugar. Price 5 cents.
- *1392 F. Black Walnut for Timber and Nuts. Price 5 cents.
- 1628 F. Growing Black Locust Trees. Price 5 cents.
- 1459 F. Selling Black Walnut Timber. Price 5 cents.
- 1405 F. The Windbreak as a Farm Asset. Price 5 cents.
- *1453 F. Growing and Planting Coniferous Trees on the Farm. Price 5 cents.
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- 1892 F. Pruning Southern Pines. Price 10 cents.

Leaflets

- 29 L. The Farm Woods; A Savings Bank Paying Interest. Price 5 cents.
- 86 L. Protect Hardwood Stands from Grazing. Price 5 cents.
- 153 L. How to Cut Southern Farm Timber for Steady Profit. Price 5 cents.
- 156 L. Harvesting and Selling Seed of Southern Pines. Price 5 cents.
- 208 L. Intensive Projects under the Cooperative Farm Forestry Act. Price 5 cents.
- 84 L. Planting Black Walnut. Price 5 cents.
- 159 L. Planting Southern Pines. Price 5 cents.

Yearbook Separates

- 1744 Y. The Place of Forestry in the Farm Economy. Price 5 cents.

Miscellaneous Publications

- 357 MP. Southern Pines Pay. Price 5 cents.

OTHER PUBLICATIONS

- *CCC Forestry. CCC Forestry Publication. U. S. Forest Service and Office of Education, Federal Security Agency, Washington, D. C. Price \$1.
- *Farm Forestry, Vocational Division, Bulletin No. 196, Agricultural Series No. 52, U. S. Office of Education, Federal Security Agency, Washington, D. C. Price 15 cents.